

A&B

£1.25

COMPUTING

FOR USERS OF THE **BBC MICRO AND ELECTRON**

*Welcome to the
Pleasure Dome*

Visit Xanadu

**Generate your own
adventure**

**Two Electrons to
be won**

**Enter Dragon
World**

REVS - on review

PLUS:

**Hard Discs, Wordwise
Plus programming,
Making the Most
of Logo, Down to Earth,
Feedback - new reader
interface**



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A&B Computing is constantly on the look-out for well-written articles and programs for publication. If you feel that your efforts meet our standards, please feel free to submit your work to us for consideration for publication.

All submitted material should be printed or typed, double spaced. Any programs submitted should be listed (55 character width emphasised if possible). A cassette of the program alone will not be considered. All programs must come complete with a full explanation of the operation, and where relevant, the structure. We also require the program in machine readable form (cassette, 40 track 5¼", or 3" disc) plus any suitable screen photographs, printer dumps and so on.

All submissions will be acknowledged and the copyright in such works which will pass to Argus Specialist Publications Limited will be paid for at competitive rates. All work for consideration should be sent to the Editor at our Golden Square address.

Volume Two Number

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Seven July 1985

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All work for consideration should be sent to the Editor of A&B Computing at our Golden Square address.

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Attractive computer graphics are quickly making their mark in many walks of life, for practical presentation of facts, for games and for computer fine art. In the August issue of A&B Computing, out on the 5 July, you will be able to sample some sensational computer graphics, beginning with the cover. There are features on how it's done, and how you can do it too. There's also some terrific software to let you create cartoon characters, accurate line drawings, three dimensional objects and much more. Plus a review of the official Acornsoft Graphics Extension ROM.

NEW: Unique to A&B Computing — a foolproof method of entering program listings!

From next month all listings will contain a simple yet thorough error checking system, line by line. Find out how it works in next month's issue.

Wordwise Plus is turning out to be so much more than just a wordprocessor. Jonathan Evans has produced some highly practical software exploiting the interactive abilities of the program.

Alan Rowley begins his expert look at events.

Jon Vogler bring you some of the finer aspects of business computing with the help of the Torch Graduate

Trevor Attewell gives the tracker balls a try. How easy do they make it to work with the micro?

Gordon Taylor combines an Acorn Winchester disc and Viewstore, the latest ROM addition to the View family with...what results? Find out next month.

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Domesday Project

Fiona Eldridge

Are you taking part in the BBC's Domesday Project? Or more to the point, do you know what it is?

Is all that Domesday conjours up a distant memory of second form history lessons? Something to do with William the Conqueror wasn't it? Even if that's all you know of Domesday then you're not too many years behind for William's massive Domesday Book of 1086 was the inspiration for the BBC's massive Domesday Project — a Domesday 'book' for the 1980s that would have been beyond William's wildest dreams.

Of course, the Domesday of 1986 will be very different from the original. In the first place, William's Domesday only surveyed a fraction of the land of Great Britain, whereas the Domesday Project will cover the whole of Great Britain — from the Shetlands to the Channel Islands. Secondly, William the Conqueror ordered the 'survey of the lands of England' to be carried out by his officials for financial reasons: he wanted to see just how much his newly conquered land was worth. Questions were asked, answers extracted and the value of the land and smallholdings assessed — right down to the last pig.

Domesday 1986 is very different. All the data and pictures are being submitted to the BBC by volunteers or collected from national data resources and the Project is covering far more than just land use and value. The BBC hope that the Domesday Project will show a complete picture of life in Britain in the 1980s, from local land use and amenities to industry, ecology and culture nationwide.

The most exciting difference between the two Domesdays though is the new technology being developed especially for the Project. As parchment is rather difficult to come by these days, all the information on local areas is being compiled on BBC micros in schools, colleges and community groups and submitted to the BBC on floppy disc. All the local and national information, pictures and maps for the new Domesday will then be stored on two interactive video discs; a 'people's database' of local information on the whole country, and a massive database of national statistics. Together, the



Michael Wood and Sarah Greene with the Domesday System — BBC, monitor, videodisc and Domesday disc.

discs will hold enough information to complete two sets of the Encyclopaedia Britannica.

All the information — text and pictures — will be displayed on screen via a computer linked to an interactive videodisc player. The videodisc player is being developed by the BBC in conjunction with Philips Electronics and it's hoped that both discs and player will be available by the end of 1986.

SO WHAT'S NEW?

When A&B last reported on the Project (Microclass, April 1985) it was still in its infancy and it was hoped that some 10,000 schools would help take part. Domesday 1986 is now well under way and it's quite likely that as a BBC owner or user, you're already taking part. All the schools received the necessary documentation in March and the BBC are amazed with the response they've received. Over 13,000 schools and thousands of colleges and local groups are currently busy collecting information and taking photographs of their local areas.

In order to collect very 'local' information for the local disc, the entire country has been divided into about 23,000 4 x 3km blocks. Obviously in urban areas there are several schools in a block of this size so a certain amount of cooperation is required. Conversely, there are large tracts of land, particularly

in Scotland, with little or no population so local landowners are also contributing information.

The BBC are, not surprisingly, very excited about the Project and having seen a demonstration of the System, I must admit to being very impressed. Using the local disc you can select any locality in Great Britain and 'zoom in' to look at an Ordnance Survey map of that area in ever greater detail. Control is quite simple using the cursor keys and even easier with a mouse (the videodisc player will be mouse compatible). You can then access information and photographs on local land use, natural resources, amenities, landmarks or find out about the origins and history of the locality. In fact, anything that the people compiling the data in that area thought would be of interest.

Just think how useful this facility could be for schools or organisations planning a holiday or field trip. A suitable place can be selected, vetted and the itinerary planned without a single suitcase being packed!

Work on the local discs should be completed and submitted to the BBC by the end of July in order that all the data can be processed at Loughborough University during the summer holidays. Instead of enjoying a peaceful vacation, the university should be a hive of activity this summer as temporary computer staff expect to be inundated with thousands of BBC

floppy discs from all over the country. If your school or college is taking part, don't forget to send in your discs before the end of term or there could be a lot of frustrated thumb-twiddling going on at Loughborough this summer!

The national data disc is equally impressive. The main menu covers five topics: Commerce and Industry, Culture, Ecology and the Environment, Science and Technology and Society. Either by menu or direct access if you know what you are looking for, you can search for information on practically any subject. Just as an example, on the prototype disc, I saw population density maps, photographs of famous British stamps and the (estimated) market shares of the national dailies over the last ten years but with the resources of the National Data Archive at the disposal of a skilled team of researchers, the potential of the national disc is enormous. Because the discs are 'interactive', you can choose to access the data in several ways — statistical information can be represented in pie chart or bar graph form, computer generated graphics can overlay maps and you can define your own keys to any particular chart to gain the exact information you require.

A feature of the national disc that I particularly like is the ability for the user to take several surrogate journeys through a typical 1980s environment. Looking at photographs taken at one metre intervals — forwards, backwards and to either side — you will be able to 'walk' through a wood, along a seashore, through a town or into a house without having to get up from your chair. This is not supposed to replace the real thing, rather to encourage people to go and explore for themselves an environment that they might not otherwise have seen, as well as provide a picture of a typical 1980s environment that may well disappear in the future.

CONTINUED OVER

DOMESDAY 1086 • A SURVEY of the LANDS of England



DOMESDAY 1986 -- CREATION OF PEOPLE'S DATABASE OF THE UNITED KINGDOM?

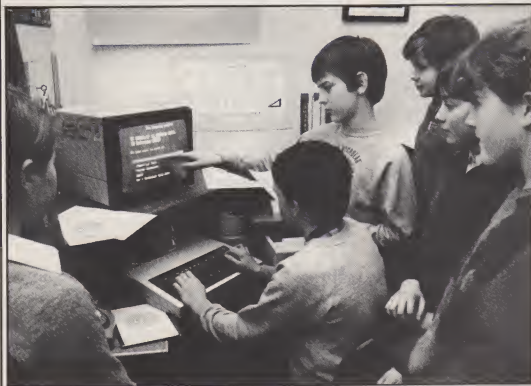


WHO USES A CAR? ... A 125 TRAIN? ... A 747 JET?

TRANSPORT



Who has a horse? Who has a boat?



Children of St Nicholas' School, Kenilworth at work on the Project.

CANDID CAMERA

To coincide with the 900th anniversary of the Domesday Book, the BBC will be screening a six-part television series about Domesday, presented by Michael (In Search of the Trojan War) Wood in the autumn of next year. The television series will complement the Project in looking at the original Domesday, and how Britain has changed in the intervening 900 years. Watch out for more news once filming gets under way.

You might have seen the 'Introduction to the Domesday Project' programme shown on BBC1 at the end of April. If you didn't, don't despair as there will be another programme this September with the latest news on the Project and the results of the national photographic competition in which you can take part.

Amongst the 150,000 or so stills that will be on the Domesday discs, the BBC would like 5000 pictures showing life in the 1980s, as seen by the Great British public. So here's your chance to take part in the Domesday Project 1986 —

Agriculture and Food Production



How Many Beasts?

How Many Serfs?

whether or not you are already. Apart from the incentive of possibly seeing your picture on disc, you could win valuable photographic equipment if your photograph is a category winner. Full details and conditions of entry are on the entry coupon at the bottom of the page. (If you don't want to decimate your copy of A&B, you can obtain further entry forms from your local BBC centre or send an a/s to the competition address.)

WHAT PRICE, DOMESDAY?

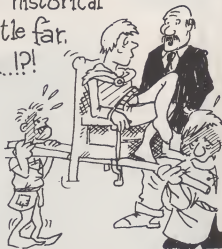
In an earlier issue of A&B, the Domesday Project was described as "one of the most ambitious cultural and technical projects of all time". Having seen a working demonstration of just a fraction of what the system will be able to do, I

don't think that this is an exaggeration. As a historical record and an exciting and versatile reference tool, the Domesday System should find its way into schools and colleges, libraries and many other institutions throughout the country. It has an infinite number of possible applications and should be the springboard of innumerable imaginative projects. My only major doubt is the cost.

No definite price is fixed as yet but it is likely that the videodisc player will be just under £1000 and the two Domesday discs about £50, or £100 for a set that includes the television series as well. Even supposing that a potential buyer already has a BBC micro and monitor (a television would not give a signal of sufficient quality) the Domesday system will not be cheap. For a commercial company or cor-

porate organisation, perhaps £1100 is not such a large sum, but for a school that can hardly afford

white paper or pencils, such a price might put the Domesday System out of reach.



Domesday cartoons by Jonathan Hall.

The Domesday Project National Photographic Competition

CALLING UK photographers! This is your chance to have your pictures included in the Domesday Project which is arguably the most exciting new national archive for 900 years. Photographic prizes worth £4,000 can be won.

Over 150,000 stills will be on the Domesday video-discs and what's needed are pictures which are not just technically and artistically pleasing but especially imaginative in bringing to life an aspect of the UK in the 1890s.

There are six categories: 1, Street life; 2, Country life; 3, Fairs; 4, Leisure; 5, Work; 6, Home life. Only 35mm slides, taken in the 1890s and oriented horizontally, can be accepted. Please read the rules carefully.

The project is offering attractive prizes for the best pictures submitted, according to a panel of judges including project editors, advisers from technical consultants Kodak Ltd, and independent experts: your choice of photographic materials and equipment up to a total of £1,000 for the best overall picture and £500 worth for the best in each category.

But what's really wanted are the country's 5,000 most informative and imaginative pictures to store on the Domesday discs. Senders of pictures selected will each receive a commemorative certificate.

Rules and entry form are alongside; the contest address is Domesday Photo Contest, Hemel Hempstead, Hertfordshire HP1 1JU and the closing date is 27 September 1985.

- 1 UK residents may enter, except employees and their families of the BBC, Kodak Ltd and others connected with the contest.
- 2 Entries must be 35mm transparencies taken in the 1890s oriented horizontally. No slide format can be accepted and no glass-mounted slides may be submitted.
- 3 Prizes will be awarded to the senders of slides which, in addition to technical and artistic quality, most aptly and vividly depict an aspect of UK life in the 1890s in the chosen category. Senders of pictures selected for the Domesday discs will receive a commemorative certificate.
- 4 Last date for receipt of entries is 27 September 1985. Winners will be notified by 8 November 1985, and prize-winners' names and counties will be available after that date from the competition address, on sending an a/s. Major prize-winners' names and counties may be announced on TV.
- 5 Each slide may be entered for one category only and must be accompanied by a full and correct copy of the entry form. Photocopies of slides are acceptable and further forms are available from the contest address (sent last and from other BBC centres). Each slide must also be labelled on the reverse of the mount with the entrant's name, address and the category for which the slide is entered. More than one slide may be submitted in any category, up to an overall maximum of 12 slides per entrant, provided they are all submitted in one entry package.
- 6 Entrants must hold copyright in the slides they submit. This copyright will remain with the entrant but it is a condition of entry that the BBC's Domesday Project may reproduce and publish without charge any slide on the Domesday discs or in associated information and publicity materials, including TV broadcasts and public exhibitions. No usage beyond the needs of the Domesday Project will be made without further permission from the entrant.
- 7 All entries will be returned during December 1985, provided a stamped addressed envelope is enclosed. The organisers reserve the right to make duplicates of any slide for the purposes of the Domesday Project, subject to rule 6.
- 8 Judges' decisions will be final and no correspondence will be entered into. The judges reserve the right not to award prizes where the quality of entries in any category fails to meet the required standard.
- 9 While every effort will be made to safeguard entries at all stages, liability cannot be accepted for loss or damage, however caused. Proof of posting will not be accepted as proof of receipt.

THE DOMESDAY PROJECT NATIONAL PHOTOGRAPHIC COMPETITION

(Technical consultants: Kodak Ltd)

Post to: DOMESDAY PHOTO CONTEST, Hemel Hempstead, Hertfordshire HP1 1JU

ENTRY FORM: Please send a completed copy of this entry form for EACH slide entered. Up to 12 slides may be submitted by each entrant.

ENTRANT'S NAME

ADDRESS

Category this slide is entered for (tick ONE only):

Street life in the 1890s

Country life in the 1890s

Fairs of the 1890s

Leisure in the 1890s

Work in the 1890s

Home life in the 1890s

Caption and description (BLOCK LETTERS, PLEASE, ONE PER ROW)

Short caption, including name of place where taken:

(eg: MODERN LIBRARY IN ANYTOWN)

Further description:

(eg: NEW LIBRARY COMPLEX IN ANYTOWN DESIGNED BY A.R. DITCHET AND FEATURING

A REVOLUTIONARY NEW TYPE OF ROOF STRUCTURE)

NB: please enclose a/s if return of your slides is required

DECLARATION

I have read and agreed to accept the rules of the contest, including the duplication of any of my slides for the purpose of the Domesday Project, subject to the provision of Rule 6.

Signed:

Date:

Not So Hard Discs

Jon Vogler

If the expense of a hard disc system is all that has prevented you from buying one, think again. You might change your mind.

"Attempt the end and never stand to doubt; Nothing's so hard, but search will find it out."

from *Seek and Find*
by Robert Herrick, 1591-1674

WHY BUY AN EXPENSIVE HARD DISC DRIVE AT ALL?

Why did you replace your tape cassette with a floppy disc drive? The answer of course is that the floppy disc drive is far faster, more convenient, involves less work by the computer operator and offers random access. Then perhaps you advanced to a dual, double-sided floppy drive and a better filing system so that more files and more file capacity could be fed quickly into the computer. Once you had started using proper business programs, or a combined word processor and data base for mail merging, you would not dream you could ever tolerate a single disc, let alone a cassette set-up.

The leap from even the largest capacity floppy disc drive to a hard disc is just as great. Vastly more data is available and it can be read and written much faster. Suddenly every file you could possibly want is (almost) instantaneously at your disposal. They load faster and more quietly. Best of all is reliability. Because floppy discs are

placed on dusty desk tops, scratched and bent and have biscuits eaten and hair combed over them, their reliability is very poor. Winchester's can fail but I have not had a single corrupt file in the four months I have been using one. No more sickening screen messages: "disc fault" when even the most expensive floppy discs do not quite engage correctly. Above all there is no infuriating shuffling of discs in and out; reaching for your loose leaf index, finding that you have not updated it, wondering on which disc, three days ago, you saved the file you now want.

WHAT IS A "HARD DISC"?

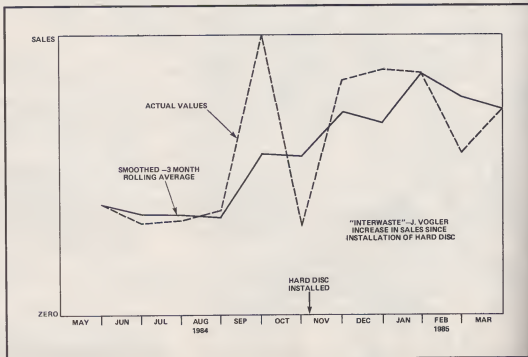
"Hard" or "Fixed" or "Winchester" discs have been used on almost all large "mainframe" computers and have been around much longer than the "floppy" discs and drives with which most readers will be familiar. The way in which data is "written" to them and "read" from them is almost the same as floppies but the discs bearing the magnetic recording surface are permanently mounted inside a dust tight casing. Because the heads do not have to follow the uneven path of a flexible disc and because dust particles cannot interfere, the discs can spin faster: 3600 rpm compared with about 200 rpm for a floppy. The read and write heads do not touch (and wear) the surface of the discs as they do on a floppy, but float on a cushion of air, five millionths of a millimeter (five microns) thick! They can discern data that is packed far more densely: typically 160 or 320 tracks compared with 40 or 80 on a floppy and 33 sectors on each track, compared with 10 (or 20 on "double density"), so that each sur-

face (2 per disc) can hold two and a half million characters of information. Because the discs are not changed they can spin continuously and no time is lost in starting and stopping.

The Winchester unit is usually bought from a specialist supplier: the firms mentioned here just add electronics, cabinet, software, etc. The unit is sealed and, although air can enter, it is filtered so that any particle bigger than two millionths of a millimetre is excluded. A smoke particle is typically 250 millionths of a millimetre wide, so if a friend lights up the tobacco smoke will not enter that critical five micron gap.

HOW THE BENEFITS APPLY IN PRACTICE

For any one using the computer for serious business operations, the benefits are substantial. In the three months since TORCH lent me a hard disc, I calculate my personal productivity has increased by about 30%. This is not just a desk calculation: you can see it in



my (computerised) sales ledger: the number and value of invoices that I have sent to customers during the period bears it out. Fig. 1 demonstrates this: I have reduced the graph to a base line of 100 for reasons of confidentiality but if any reader wants to audit the figures, he or she will most welcome. Finally I decided I could not live without the unit and bought it outright: the justification for the investment is set out below.

Increased productivity for the single user is not the only compelling reason for buying a hard disc: the other is to serve a network. The use in the classroom, of many BBC micros all linked together with ECONET or some other network, so that the teacher can, without moving, intervene to help or supervise any pupil, has been widely discussed. Less has been written of the business potentialities, but a large office or small factory can get huge benefits by linking the transport office, the stock controller, the buyer, the accounts clerk and so on to the same computer programs and files. This has been possible with big, hugely expensive, computer systems for years. Now it can be done for a few thousand pounds but not, realistically with floppy discs: they will work perfectly well on networks but can hold too few files for practical purposes. If the accountant is working on the sales ledger floppy when the buyer wants to amend the purchase ledger on a different disc, things become confused, slow and irritable: not the ingredients of business efficiency.

WHY THIS REVIEW ONLY COVERS THREE HARD DISCS

I started work on this review eight months ago. TORCH and GSL both responded promptly and efficiently to my request for review hardware. QUEST and INTEC, both of whom had been running adverts for hard discs for the BBC, promised review units which never appeared. I telephoned both half a dozen times during the next four months and received promises,

excuses, laments: but no unit. The problem seems to be that the discwork, but cannot run the highest "level" of ECONET. Then ACORN advertised a hard disc. I visited them and was promised a review unit: same story. Even after ACORN's crisis was over I got promises, confusion and delays, but no hardware I could tell A & B readers about. I was resigned to writing a rather limited review of only two units when MIDWICH advertised one. Within days they had sent it me. Then it blew a fuse. More laments? Not a bit of it. At the earliest possible moment Midwich sent an engineer to find out what was wrong and a replacement unit so A & B readers should have their review. That shows the kind of service that some companies can provide.

I hope either that it will prove possible for QUEST, INTEC and ACORN to provide review units in the next few months, or else that they will withdraw them from the market. In the meantime readers should exercise the utmost caution before buying equipment that the manufacturers are unable to submit to reviewer's scrutiny. If any A & B reader has experience of these products, please write and tell us.

GSL WINCHESTER DISC DRIVE 1 THE HARDWARE

GSL started life as suppliers of electronic equipment to the Ministry of Defence and it was in this role that they developed their Winchester Disc Drive. It looks like it! It is built to withstand a Sherman tank driving over it or even use by a schoolboy: the steel sheet cover is at least twice as thick as that used on the cabinet for my Cumana RODIME hard disc unit, made in Scotland. The connection from the hard disc to the BBC is very simple, a ribbon cable into the 1MHz bus socket underneath the computer and a mains lead. It is equipped with a key as an additional security measure.

When you buy the hard disc, in any size: 10, 20 or 40 megabytes (and you can go even bigger, up to 400 megabytes in theory — that is equal to about four Encyclopaedia Britannicas! but over 80 megabytes is the largest supplied so far) you in fact get two systems as the unit incorporates AMCOM's E-NET — a networking system that operates through BBC Econet hardware but is able to handle up to 200 computers. Although it can be used as a "stand alone" hard disc drive, it is not ideal because:

- 1 It is physically very large: a pity because it contains mostly fresh air: there is space for a second hard disc unit (or a "streamer-tape back-up": a cassette unit whose huge tapes will store the entire contents of a 20 megabyte disc in about ten minutes) and the transformer and controller boards are generously surrounded by space. The space it takes up on a desk can be limited by positioning other things on top of it, such as the monitor or floppy disc unit: even so it is rather greedy of space.
- 2 The cooling fan is noisy (about twice the sound intensity of the Torch unit and a real distraction in a small room).
- 3 It does not contain a floppy disc drive: you would have to buy one as well.

2 SOFTWARE

The obtrusive hardware is not really significant when performing its intended function: as the master of a tribe of networked slave computers, spread around various offices and departments of a small commercial office or factory. It is with this in mind that the extensive software is planned and it is powerful, practical and effective. It can be broken down into three categories: the utility package, the file server commands and the Winchester commands.

The utility package comes on a separate floppy disc and is concerned with setting up users: each computer that is networked into the system has a different user number and, associated with this, its own password. Only by using that password can that user write

to "record data or alter" a file but without it files can still be read — provided the "security priority" of the file permits.

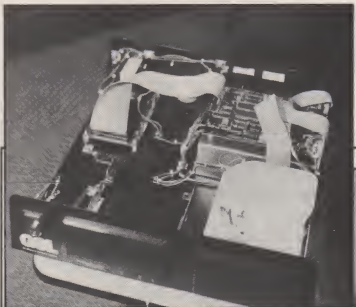
The priority code is also assigned to each user: the higher your code, the more files you can read: at the top the system manager has the highest priority and can read everything. One cannot read the files of other people with equal priority so, if the sales manager and works manager both have priority 20, they could not read each others files but could read those of the despatch department (priority 10). The managing director, with priority 40, could read either of their files however. Users can also be grouped together in "forms" for access: for example if there were four different sales departments, each with one or more computers, they could be grouped together as a single form and those files that they alone use could be so coded to restrict access by any other department.

The amount of disc drive space to which each user has access can be determined by the system manager and GSL go to considerable lengths to encourage users to select file sizes that will make it easy to back-up onto floppy discs. If you create a hard disc file that is too large to back-up onto a single floppy, you are encouraged to break this down to "sub-drives" each of length equivalent to a single floppy. The system uses the AMCOM floppy disc controller which it describes as more advanced than the Acorn DFS. Although the advantages appear small to the single user, it is this that has resulted in GSL producing a highly professional system where others have failed completely.

The file server commands are concerned with operating the network. For example, they permit the system manager to alter the priority level of a file or a group of files or the slave machines to send messages to the master computer.

The access users have to random access files: although it may be desirable for several people to be able to read the sales ledger, it would be disastrous if they tried to sell the same product, to a different

CONTINUED OVER



The GSL unit takes up a great deal of desk space as it contains mainly fresh air.

4 This provides good cooling and space for a second unit or a streamer tape.

customer, at the same moment and there are commands to try and control this.

Close supervision — obviously aimed at education but invaluable in conferencing or in any business, such as broking or process control, where things happen fast (and often irreversibly) and the supervisor wants to know what subordinates are doing at the time, not afterwards. For example, the user of the master computer can:

- 1 Receive reports on which slave computers are using the system: for example to save or load files, and what errors are occurring.
- 2 Pass messages to one or many slave users: for example, to demonstrate techniques.
- 3 View everything that is happening on a slave computer (without the slave user knowing anything about it — shades of 1984!).
- 4 Actually take over the screen of a slave user.

There is a nice vein of humour in this system: for example the command to pass messages to many slave stations is called — "SHOUT" while, if a user tries to delete a file that is marked with another user's number, an admonishing "NAUGHTY!" appears on the screen.

The Winchester disc drive commands are very similar to the standard ACORN DFS commands: "ACCESS", "ENABLE", "WIPE", "BACKUP" etc, but in addition there is a range of commands

associated with creating a "hierarchical" file structure and this is a great strength of the system. A hierarchical structure is one like a traditional line management "family tree". A main catalogue can contain anything up to 63 "sub-drives", of any size between 1K and the full disc space available and able to contain up to 255 files. These sub-drives however can, in turn, contain a further three levels of sub-sub-drives. By simple commands such as "GOTO" and "GO-SUB", you can work your way "down the tree" and, by "RETURN", back up again. (If you go too far back up, you get a cryptic error message "stack overshoot" which no doubt means something extremely computerish and technical but is of little help to the average business person.) One can list all the sub drives defined within the current drive and one can also give a single letter label to up to 5 sub-drives to save typing in long drive hierarchies.

As the normal BBC disc filing system categories, such as "directories" and "libraries" are also available, these, coupled with the variety of user numbers, variety of priorities, and a hierarchy system

that in theory permits up to one thousand million file names (in practice: any number, limited only by disc capacity) there are no less than four different methods of organising files and this is particularly important in large organisations where security and confidentiality of information are of vital importance. I found it difficult to learn these systems, and the handbook was not fully adequate in helping me. However, once a system manager became familiar with it, no doubt these problems would be rapidly overcome and the power of this comprehensive file management system could be fully utilized.

I had two main criticisms. The first was that I could find no way of finding, at any time, any file anywhere among the various levels of sub-drives on the system. When one is using a large disc, possibly with thousands of separate files, some will actually get lost; especially if one forgets the name or the subdrive on which one saved them. Some rapid way of finding them is essential. GSL suggest one should use "USER", which lists all the files on the section of the hard disc allocated to a user, and encour-

rage users to write their own simple program to perform this automatically for all users. However, this command is not mentioned in the handbook and I take the view that such features should be available for those without the time or skill to write their own programs.

Secondly, the error message information was poor. I have already mentioned "stack overshoot"; I was none the wiser when I got "Winchester error 21" and nowhere in the handbook was there a list telling me what this particular error was. GSL issue a printed sheet of error messages but it is not very helpful.

Apart from this, the GSL Winchester drive performed as an efficient hard disc unit, giving extremely rapid access to files in an effective and reliable fashion.

3 HANDBOOK

The handbook is actually published by AMCOM, not GSL, and I found it well-produced and easy to read. It lacked a proper index but the contents list was fairly comprehensive. A new, indexed edition is promised. As well as



being short on error messages it ought to include a complete chapter on how to build up a logical structure of hierarchical files, complete with a few diagrams. In particular it should show the relationship between files and sub-drives that relate to the same drive.

4 ASSESSMENT

The 10 megabyte disc sells at £1450 plus VAT and the 20 megabyte at £1750 plus VAT. Both of them are practical and satisfactory and good value for stoutly-made hardware plus networking software if you are content to work with the BBC operating system, but will not work with a Z80 second processor. For a single user the cost is rather heavy, as you will need to buy a floppy disc drive in addition, but for running a network, the excellent software and filing system will take a lot of beating. GSL say that they are about to launch a stand-alone business unit, with a Z80 giving CPM compatibility, and selling at around £1850. It will use their own software, not AMCOM's and I await it with keen interest. I just hope that the new business unit will be a bit more economical.

MIDWICH 5 MEGABYTE UNIT

In contrast to the voluminous GSL, the Midwich 5 megabyte hard disc unit is exceptionally compact and admirably shaped so that it sits comfortably on top of my floppy disc drive. The floppy is necessary because the 5 megabyte model comes without an integral one, although the larger 20 and 25 megabyte models, promised shortly, have built in floppy back ups. This compactness is achieved by mounting the fan underneath, with the power supply upside down and directly above it. The other end of the box is completely taken up with the Shugart Winchester drive and the circuitry mounted directly above that.

The metalwork is substantial and well finished, but the front of the unit is in rather cheap looking black perspex, on which the familiar Midwich green logo does not stand out. In operation a glaringly bright LED flashes behind the per-

The GSL uses E-Net with a hierarchical file structure. This screen shot shows the process of going down the ACCOUNTS branch.

spect to indicate that the Winchester is reading or writing. The unit comes with a ROM that replaces the DFS ROM inside the BBC micro and a utilities disc.

The Midwich unit works with "Levels 1 and 2" of Econet, serving about 40 users and is predicted to work with "Level 3" which is currently being released. However on Level 2 only about half the total capacity can be "on-line" or accessible at any time. (Readers not familiar with Econet: see insert box). Midwich have got over the problem of keeping track of large numbers of hard disc files by splitting the disc into 26 different "volumes" (further confusion for those already bemused by files, directories, libraries but at least logical!) each of 200K bytes, the size of an 80 track, single density, single side floppy disc. These can be treated almost exactly like floppy discs but give hard disc performance. For further compatibility with floppies, four floppy drive numbers are also provided in the same sequence. For readers who are about to exclaim:

"But what about my accounting program which knows that the applications program is kept on drive 0 and the data file on drive 1? How will it know to look on drives 10 and 16?"

Midwich have thought of this one. You can "assign" any drive numbers to drives 0, 1, 2, or 3. These are only "logical" drives, neither the hard discs, which start at 4 or the floppies which start at 30, physically occupy them. Such assignments are made with a simple "ASSIGN" and can be altered at any time — an imaginative system of great flexibility. When using Econet Level 2 and the problem referred to above, those parts of the disc that are inaccessible at any moment can be assigned to accessible parts when required, but must replace other, dormant files.

I have one criticism which is that there is no way of finding a particular file. To have to search among 26 different volumes is why people balk at buying the Encyclopaedia Britannica and the Midwich hard disc has the same problem. Midwich recommend that users carefully "Title" each volume but as titles are restricted to 12 characters, this is not really practical.

The other delightful thing about the Midwich hard disc is that you can also allocate each volume to a different kind of filing system, straight BBC (called MWRFS and almost exactly equivalent to DFS), Econet or CP/M for use with ACORN's Z80 second processor. This is a splendid feature, sadly missing on both the Torch and GSL hard discs, but unfortunately, having bawled so brilliantly, Midwich then totally fail to take the catch! Nowhere in the 70 page handbook is there any instruction as to how to transfer to other filing systems. As the Econet and Z80 handbooks certainly do not give you this information, you are left unable to do anything. I successfully managed to designate four volumes as CP/M surfaces A,B,C and D but could not manage either to format them or to copy CP/M files to them. Nor was there any indication as to how the computer would know whether a file specification containing an A: or B: would refer to the floppy or the hard disc volumes. Midwich should include this information in the handbook as a matter of urgency. I have since been told by Midwich that the unit will not currently run with the Torch Z80, although such a unit is planned. And that with an ACORN Z80, the hard disc will only operate like a pair of fast floppies, so there is no access to masses of file space except by "assigning"; and that even this is better than the ACORN hard disc which will not work with their own Z80 at all!

I was therefore only able to operate in the straight BBC mode and found it pleasant and fast: a text file which took 23.7 seconds to load into WORDWISE from 80-track, single-density floppy discs got home in just 12.7 seconds from the hard discs with a barely audible sound. However, once I got beyond simple loading and saving operations, troubles began. There is a PROTECT command which serves the same function as the "WRITE PROTECT" tag on a floppy disc. On invoking this, I was told:

"ERROR ON SYSTEM DATA BLOCK. CHECK WITH MANUAL"

CONTINUED OVER

```
Drive : => ACCOUNTS
Length 00000k Number of files 03F
Option 0 User 0000
Directory $ Library 0000.$
Work $
```

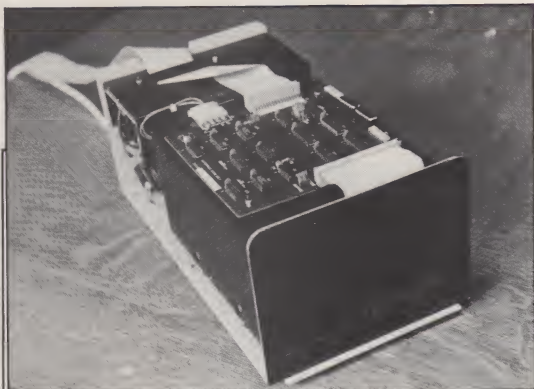
```
UTILITY L NOMLED
SALELED PURCLED
OFFICE
```

```
>>GOSUB OVERHEAD
```

```
>>
Drive : => ACCOUNTS
Length 00020k Number of files 027
Option 0 User 0000
Directory $ Library 0000.$
Work $
```

```
SALEREPS WORKS
SITEINST TECHREPS
SERVICE
MANAGENT
```

```
>_
```



Midwich 5 hard disc: small and compact.

Likewise with the command which selects the volume that will boot start when you hold SHIFT and tap BREAK. Other commands, to do with locking and unlocking, backing up and deleting files, stimulated the error message:

"WINCHESTER DISC FAULT 1C"

I duly looked up the error message list in the handbook, but this particular one was not mentioned. I tried all the normal tricks: switching the computer off, switching the hard disc off, switching everything off then switching them back on again. The second time I did this, the unit blew a fuse and I had to be rescued by a helpful Midwich engineer.

Midwich have gone to considerable trouble to pack the equipment extremely carefully and it was delivered by a courier service who are normally used to handling delicate equipment. Mounted on the box is a device known as a "shock-watch": a slim glass ampoule which turns red to indicate rough handling. The shock watch on my unit was definitely blushing, but there was no visible sign of damage to the packing or the equipment, which functioned perfectly when first installed and for the first two or three hours of use. I can therefore only conclude that the above problems are the kind of "bugs" commonly encountered on new products and would

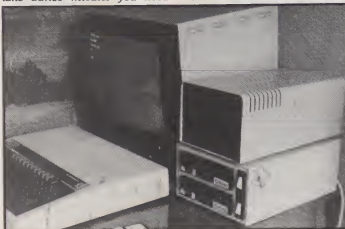
urge readers to take the necessary precautions:

- 1 Buy through a local dealer (close enough for convenience if you have to return the equipment).
- 2 Alternatively consider Midwich's excellent offer of a 24-hour "get you working again" service, costing £65 per year.
- 3 Get the dealer to demonstrate, in the showroom that the machine will work with your computer and in particular that the Protect, Boot, Access, Backup, Destroy and Title commands all operate.
- 4 If you are a Z80 or Econet user, insist on receiving full instructions and demonstrations of how to transfer individual volumes to these filing systems.
- 5 If you operate a network, take advice whether you need

Level 3 (probably only if you run a substantial database) which is expensive or can get by with Level2.

ASSESSMENT

If the above matters can be overcome, Midwich's 5 megabyte hard disc is a good product at a comparatively low price. For the small business or home user, who does not need huge capacity but wants speed, silence and freedom from floppy disc errors and shuffles, it is an obvious choice. It offers the substantial benefit that, if they graduate on to an ACORN second processor, they can still use this unit, provided someone tells them how!



The Midwich unit sits conveniently on top of the

floppy disc drive. (The drive is external and not built-in.)

TORCH HDPZ80 20 MEGABYTE HARD DISC

The unit comprises a steel box eight inches wide, 10 inches deep and no less than 13 inches high: a most distinctive new object on your desk. Densely and craftily compacted, this contains:

- a single dual sided floppy disc drive - the 20 megabyte hard disc - the hard disc controller board - the Z80 second processor - and, if you want and can afford it, a Neptune third processor with a Motorola 68000 chip and 256,000 bytes of random access storage which can be increased to a million bytes and can run Unix and many other operating systems.

When you remember that, 10 years ago this was about as much computing power as the Pentagon had available, this is a rather potent machine to have at your fingertips.

There are one or two disadvantages: lets dispose of them right away. Firstly, the cables are so short that this beast has to live right beside your BBC. My first action when I had unpacked it was to get a hand saw and carve a great chunk out of my nicely carpentered computer desk. Surprisingly, I found little inconvenience: in fact it provides a rather handy table on which to place paper while I am printing and the carefully engineered air cooling slots at the top continue to function even when I mis-use it in this way. Secondly, there is a continual hissing sound: this is due to the cooling fan rather than to the disc unit itself and is so swishy and soothing a noise that I soon forget it is there. It contrasts pleasantly with the raucous sound of my floppy disc drive: when the disc is operating, you can just hear a subdued clunk if you put your ear very close to it. I remember the overheating problems I had last summer, due to the Z80 being underneath the lid of my Beeb, and am looking forward to this summer with the Z80 out of the Beeb cabinet and properly cooled.

Compared with the CSL disc drive, it has a very small "footprint": no more than a sheet of A4. The floppy disc drive is at a most



The Torch Unicorn has to sit very close to the BBC. In practice this is quite convenient.

convenient height and seems to be far better engineered than any other I have used: I have not had a single "disc fault" error message. Of course it is used so much less frequently that this is perhaps not a fair comparison. The unit links into the BBC micro in three ways: into the disc drive socket, into the 1MHz boss socket and into the tube. There is also a ROM chip which has to be fitted in the BBC.

The Z80 is a Z80B, which runs substantially faster than the Z80A in the Torch disc pack and one really does notice the difference. There is practically no waiting for software to load. I have not yet tried out the full glory of the "Unicorn" ("UNIX on a CORN"): the 68,000 processor and Unix software pack but shall report on them in a future issue.

USING THE TORCH SYSTEM

There are other, more subtle reasons for the great increases in productivity described at the start of this article. The first is to do with "command files". These are one of the most attractive features of the Torch Z80-based CP/M system: one can write short, simple programs to carry out a sequence of

activities that are frequently repeated. I use one, for instance, to load my Sage accounting program, provide a soothing screen colour, switch the printer on and define user keys; another to find a given name and address on the database and print it on the front of an envelope of a given size. The problem in the past has been that, once a floppy disc has been filled with some major application program, there is only limited space left on it for the command files. Command files are all about *SPEED!* They are of limited value if you have to shuffle discs in the middle of their operation.

Now however, I write short, simple command files for every task I undertake. There are four or five for different sorts of correspondence, two or three for word processing different kinds of document, one for doing the books, one for timing a computer operation, one for loading the keys with basic utilities, one for cleaning "garbage" off the discs; backup files and formatted files and test files and temporary files, one for making daily back-ups of the database and another for the accounting program and so it goes on. Whereas six months ago an average business application involved typing strings of words, it now rarely involves more than two or

three single key strokes at a time. It is the difference between mowing the lawn with a "shove it as hard as you can" hand-mower and using a power mower: you still hold the handle but only to exert a little guidance here and there.

Before I had to remember detailed sequences ("BL4E4W.M" represented a business letter, to be word processed, printed on A4 paper with an A4 envelope, which is one of a general category of mail files). If my secretary or could not remember it meant looking them up in that wretched loose leaf file. Now we can use Torch's formidable do-it-yourself menu creation program "EXECUTIVE AID". This enables you to devise a hierarchy of menus: a bit slower than keying in your own commands straight off, but the only alternative once your operations reaches a certain degree of complexity.

There is a vast array of other, superb software. "FIND" will tell you where any file is, with complete "wildcard" operation if you have forgotten exactly what you called it. Use "LS" and you can list the name of every one of several thousand files in front of you: neatly sorted by disc "surface" and alphabetically, with file size, user number and protection all optionally shown. "VARDISC" enables you to carve up the 20 megabytes

into whatever chunks you prefer and "BACKUP" saves hours by not copying a file onto your "archive" disc unless it has been altered since it was last backed up. There is no facility for "tree" directories: the system is so simple and quick they are not needed and would be cumbersome.

Finally, there is the facility for multi-user operation with Torch-NET. I have bought a second Beeb so that my secretary and I can work simultaneously; so that I can test add-on hardware without disabling my writing system; so that I can edit one text, while another is printing or while looking up a train time on PRESTEL; and above all so that there is a second machine available in the event of a breakdown (it has not happened yet but becomes increasingly inevitable as the keyboard has been hammered for about five hours a day, almost continuously, for two years). With Torch-NET all machines are working units; you do not sacrifice one to be the file-server. This is the ideal for a medium-sized business: lots of low-cost work stations (under £900 each for Beeb, Econet, Z80 and monitor) each with access to formidable in-house computing power.

INVESTMENT DECISION

Although prices have been dropping steadily, a hard disc is still the most expensive component of a small micro-computer system: around £1000 for every 10 megabytes of storage. Under what circumstances is such a business investment justified? If you run training courses with a classroom full of Beebs, the calculation for a hard disc is simple. For the "stand-alone" businessman it is more difficult but goes something like the following for the Torch and a similar sum could be done for each of the other units.

SAVINGS

1 Hourly charge rate for computer and user. If you think this is high,

CONTINUED OVER

you are either undervaluing yourself or not being realistic about your business overheads! Many well-qualified professionals would set this at £20 or higher! 182 Number of working hours computer is in use per day

5 - Number of working days per year 200

4 Increase in productivity by using hard disc. Actually, as indicated above, it can be far more, but let us be cautious. 20%

5 Annual value of improved productivity = 20% of 200 x 5 x 18 = £1600

6 To this, add savings in purchases of floppy discs (costing £25 for ten 360K discs) about £150

7 Total gain £1750

CAPITAL COSTS

1 Cost of hard disc £2000 2 Less resale value of dual disc drive and Z80 disc pack (even if you use it on a second BBC) £500 3 Less tax allowances (on 50% capital value) £300 4 Net capital cost £1200

RETURN ON INVESTMENT

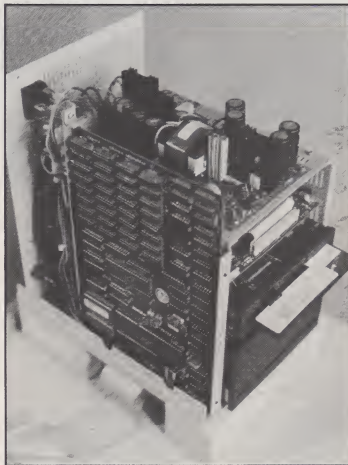
A figure to satisfy any banker: around 150%! This is good economics by any standard, even better when you remember that there will be further capital allowances in subsequent years and, as soon as a second user shares the disc pack, even if not for the full working day, then further productivity improvements will be achieved.

IS UNICORN A WISE INVESTMENT?

Investment analysis is all very well but there is also the other question: risk. For most small businesses, £2,000 is a lot of money. What if something goes wrong? In the March issue of A & B Computing I made it quite plain why I believed that the BBC family of computers offered such an attractive "upgrade path" and that they were competitive with any other business

micro computer system available. There are a number of people, who think they know, that have cast serious doubts as to whether the Unix system can dislodge MS-DOS (the original, from which IBM's almost identical PC-DOS operating system was copied).

investment will be "out of date" in one (or certainly two) years. Therefore, any decision is going to prove to be the "wrong" one. The choice is therefore to do nothing or to buy the best value equipment that does the job. For me, the Unicorn is head and shoulders above anything else available. -I have now



The Unicorn packs into a small case about the same computing power as the Pentagon had a few years' back! At the bottom is the hard disc unit, above that the floppy and then the hard disc controller board, finally

surmounted by the power pack. On the left is the huge motherboard with 32 RAM chips giving 250 Kbytes (expandable to an enormous megabyte!), the Z80B second processor and the 68000 third processor.

Obviously everyone must come to their own conclusions and many may say: "I am going to be on the safe side and buy an IBM PC-AT or an Apricot-XI". The reason why I myself am not taking this path is as follows:

Computer technology is changing so rapidly that any

got so used to the BBC, and the Torch operating system, with my books on Sage accounts and with Perfect software and DBase II tailored to my business's needs that I have a big personal "learning" investment plus a "customizing" investment, represented in the command files and personal orga-

nisation described above. My personal investment analysis looks very similar to the one outlined above; in fact it is rather more attractive. I can therefore justify this investment, even if I replace it into two years time. While I should be deeply sad to see Acorn fold up, this would not threaten my personal operations. There are over half a million BBC computers in service, so a lot of people will continue providing maintenance and repairs over the next two - or even five or ten - years. Secondly remember it is a BBC, not just an Acorn computer and I have no doubt at all that the BBC will arrange continued support.

Although Torch was almost taken over by Acorn a few months back, the deal was never finalised. Torch continues as a totally separate company and I personally believe that they are vastly better managed. Their future product development, of which I saw some fascinating glimpses on a recent visit, is in no way dependent upon Acorn. For those who want to use the BBC as a business machine on its own, with some of the excellent software from Gemini, Meadows Computers and others that I have reviewed over the past year or so, the future looks perhaps less attractive. Not because the machines and software will not continue to work but because software houses will be very chary of committing substantial programming effort to produce software for a machine that has not got a secure future. This, justifies what has been an underlying thread in these articles for many months: the BBC with a Torch Z80 is a far better prospect as a business computer than one without.

COMPARISON

Table 1 shows the prices and capacities of the three hard discs tested. An allowance has been made for the other items included in the package: networking software, integral floppy and second processor. On this basis the TORCH costs slightly less per megabyte of storage, but not enough to be significant.

In fact the three devices are so different that few readers will find

ECONET

Econet consists of separate hardware and software. The hardware comprises:

- A modification to each BBC computer that is to hang on the network, costing around £70 fitted. One BBC has to be designated as the file server and cannot be used for other purposes at the same time.
- A "clock" device with its own transformer, costing around £50.
- Cables and "terminators" connecting the various parts.
- A "file server" which can be a floppy or hard disc.

Econet hardware can be used to run other LANs (Local Area Networks) such as Amcom's E-net or Torch's Torchnet.

The software varies in complexity between three different levels:

Level 1 This basic system can carry out simple operations on floppy disc files of less than 10 KBytes.

Level 2 Needs a 6502 second processor and can handle random access files.

Level 3 For use with Winchester discs: just being released.

difficulty in choosing which is appropriate to their needs.

For the large network of BBC users, not requiring to operate "professional" (ie CP/M) business software but faced with the problems of keeping separate users independent, supervised and content, the GSL units are the obvious choice, with the 20 megabyte unit being well worth the somewhat higher price for all but the most cost-paring applications.

For the small network or stand-alone user, content to stick with the BBC operating system but wanting more speed and "less flop", Midwich offers a strikingly lower capital cost.

For the serious business, running accounts, mailing lists, budgeting or inventory control, either as a stand-alone system or with a number of networked micros, the Torch is the only serious choice.

What I hope this article will convey is that a hard disc is no longer a remote idea, a preposterous indulgence for any hard-headed, cost-conscious business person. It is a cost-effective tool for achieving unbelievable productivity gains, offering a return on investment that makes it folly not to buy one if the computer is a serious part of your business operation. The units described here cost around two months' salary for one middle income employee and can pay for themselves inside a year.

Otherwise you may one day be heard saying to the liquidator the words of the Book of Common Prayer:

"Then thought I to understand this but it was too **hard** for me!"

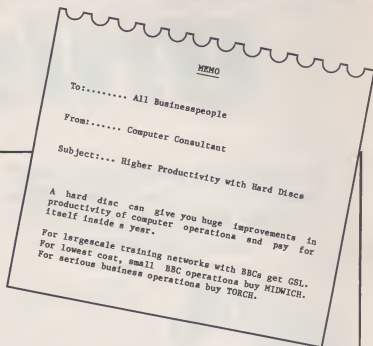


Table 1

Manufacturer	GSL	MIDWICH	TORCH
Capacity in megabytes	10 (20)	5	20
Fitted with integral floppy?	No (No)	No	Yes
Estimated value			200
Second processor built in?	No (No)	No	Yes
Estimated value			300
Price incl network software?	Yes (Yes)	No	No
Estimated value (£)	100		
Price (incl VAT)	1667 (2012)	977	2240
Cost per megabyte?	157 (96)	195	87
Uses BBC operating system?	Yes (Yes)	Yes	No
Operates with Z80?	No (No)	Partially	Yes

a Comparison of hard discs

TASK	TIME WITH FLOPPIES	TIME WITH HARD DISC	PERCENT GAIN
Load SAGE accounts with files (including inserting floppies) (floppies already in and centred)	34 secs 28 secs	14 secs	59 50
From main menu, display trial balance, item by item (SAGE accounts)	64 secs	43 secs	33
Load PERFECT FILER database and find one member out of 400	27 secs	13 secs	52
Display this article on screen and scroll through (PERFECT WRITER)	212 secs	188 secs	11
Check spelling of 1800 word article with PERFECT SPELLER	40 secs	28 secs	30
AVERAGE PERCENTAGE GAIN			39

b Time savings from hard disc compared with floppies

Making the most of Logo

Ann Owen

Two more Logos introduce themselves to Making the Most.

You will be aware by now that, after a considerable wait for any Logo at all, the BBC is now blessed with four possibilities. Only Acornsoft Logo is marketed for the Electron Plus One.

The two newcomers to this column are Logotron Logo and LSL Logo. Both are one chip 16K implementations of the language. Logotron's version is written by French company, Systems d'Ordinateurs Logo International. All the documentation however has been researched in Britain in consultation with school teachers.

Logo Software Limited formed especially to write their version. Both languages are written in Assembler (Acornsoft's is written in BCPL). This fact affords some considerable speed advantages over the double chip version but the 16K limitation does mean that some facilities are not within the chip. This doesn't mean that such facilities cannot be created as Logo procedures when needed.

HISTORICAL LOGO

Logo was developed out of the language Lisp but an important breakthrough and its most distinctive feature, emphasised by its use on microcomputers, is Turtle graphics. Versions of Logo on the Apple microcomputers and for CP/M machines have been the most influential, bringing them into the home and onto the desks of school children.

Logos for the Apple, Atari, IBM and Spectrum have influenced the development of these BBC versions. Logotron's version inherits features from three of the above but also incorporates new features to take advantage of its BBC environment and of new ideas about the use of Logo now developing in this country.

LSL Logo is less "standard" in

the way it carries out many operations. But not to the extent that translation between Logos becomes impossible. There is an MEP project going on at the moment to develop floor turtle software and this will be available in a form suitable for all four BBC Logos.

Both 16K Logos do take a stand on some features however, sometimes through necessity. Both programs are excellent however and the programmers have done a good job in achieving their individual specifications. What we are faced with is a wealth of Logos, a veritable conspiracy. "Hands on" is recommended for anyone seriously contemplating what is a substantial.

EXTENSIONS

Both Logos are naturally enough aimed at the school market with children in mind. Logotron however has especially emphasised the inherent ability of their language to expand, as Logo can, for specific applications, without compromising on speed of operation. LSL is also very capable of this expansion via Logo procedure definition. Both sets of documentation provide considerable amounts of material to work through, including useful procedures.

One drawback of having to fill the gaps by defining your own Logo procedures is the need to efficiently file away these extensions for immediate access. If you are using a tape based machine then loading and saving large numbers of procedures and keeping track of them is not easy. Both Logos seem to assume a disc system much of the time.

The individual characteristics of the Logo file handling are therefore very important parts of the language. Logotron has SAVE filename name/list, which allows you

to easily save the whole workspace or to specify a variable or procedure name or list of names for saving. LOAD recalls the file. LSL SAVE covers only named or listed procedures. Although it is very easy to list all your procedures with PROCS, it would be nice if you could save the workspace. The manual defines a procedure ALL which can be used for saving more than one procedure.

The procedures are saved as text files and can be accessed by a wordprocessor, "TYPED" etc. LSL's SPY and Logotron's DRIBBLE open a named file into which all following input is saved. This is a permanent record of a Logo session and can be printed out if needed. LSL also has OPEN-READ and OPENWRITE, EOF and CLOSE commands.

Logotron employs a very handy method, directing what appears on screen to the filing system of your choice. SETWRITE filename opens the file. SETREAD filename is used to read a text file created by SETREAD or DRIBBLE, and after SETREAD has been set, RC (Read Character) and RL (Read List) read information from the named file. SETREAD () is the equivalent of BASIC's CLOSE 0 and the newly appearing *CLOSE, shutting down and tidying up all open files.

PROGRAM LISTING

TO CHOOSE ALIST

```
MAKE "ITEMNO 1 + RANDOM COUNT :ALIST
MAKE "CHOICE ITEM :ITEMNO :ALIST
PRINT :CHOICE
END
```

```
MAKE "PRESENT [DOLL TRAINSET COMPUTER]
MAKE "JARGON [ROM RAM HIRE BIT BYTE
PCB BUS I / O]
```

Lessons in the natural extendability of Logo. LSL already had the primitive WHILE built in. The Logotron listings above demonstrate how versions can be defined.

PROGRAM LISTING 2

TO ARM

```
REPEAT 10 [FD :DIST RT 18]
REPEAT 10 [FD :DIST LT 18]
END
```

TO HELIOS

HT

```
MAKE "DIST 30
MAKE "ANGLE 0
REPEAT 20 [CPU HOME RT :ANGLE PD ARM
MAKE "ANGLE :ANGLE + 18 SETPC
SUM ( RANDOM 3 ) 1]
```

END

CONTINUED OVER

PROGRAM LISTING 3

```

TO RING
REPEAT 6 [TRIANGLE SQUARE RT 60]
MAKE "DEGREES HEADING
SETH :DEGREES + 15
RING
END

```

```

TO SQUARE
REPEAT 4 [FD 250 RT 90]
END

```

```

TO TRIANGLE
REPEAT 3 [FD 250 RT 120]
END

```

PROGRAM LISTING 4

```

TO TRIANGLE
MAKE "SIDES 3
POLY
END

```

```

TO POLY
REPEAT :SIDES [FD :EDGE RT 360 / :SIDES]
END

```

```

TO SQUARE
MAKE "SIDES 4
POLY
END

```

```

TO CIRCLE
MAKE "SIDES 30
POLY
END

```

```

TO TUNNEL :EDGE
SETMODE 0
REPEAT 10 [MAKE "EDGE :EDGE + 5 CIRCLE]
END

```

PROGRAM LISTING 5

```

TO WHILE CONDITION ACTION
IF NOT RUN :CONDITION [STOP]
RUN :ACTION
WHILE :CONDITION :ACTION
END

```

```

TO BORE
WHILE [0 = 1] [DIALOG]
END

```

PROGRAM LISTING 6

```

TO REPEAT_UNTIL CONDITION ACTION
RUN :ACTION
IF RUN :CONDITION [STOP]
REPEAT_UNTIL :CONDITION :ACTION
END

```

```

TO BORE
REPEAT_UNTIL [0 = 1] [DIALOG]
END

```

```

TO DIALOG
PRINT [TELL ME SOMETHING? GIVE ME A FACT...]
MAKE "STRING RL
PRINT [I TOLD YOU SO]
WAIT 10
CT
END

```

PROGRAM LISTING 7

```

TO DIALOG
PRINT [TELL ME SOMETHING? GIVE ME A FACT...]
MAKE "STRING RL
PRINT [I TOLD YOU SO]
WAIT 10
CT
END

```


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11

Flexible Options

Clive Grace

The Beeb has always been considered a versatile machine, its many expansion ports have ensured that it has been accepted in laboratories and for scientific research up and down the country, whereas its colour and general ease of programming immediately ensured its success as an educational tool for nearly all levels of computer based education; and with the advent of the Z80 second processor and the wealth of CP/M software, the Beeb has now made its mark in the personal business computer world.

But in the field of industrial and control applications the BBC Micro has been sadly lacking, it suffers major deficiencies when it comes to controlling machinery or reading from instrumentation on the factory floor: the fact that it has no "standard" interfaces, its Analogue to Digital conversion is for many industrial applications simply too slow and the 6502 processor is a nasty little beast to get to grips with concerning I/O and peripheral driving in comparison with other processors.

True, for many requirements the Beeb's I/O capabilities are as comprehensive as a micro can get, but industrial requirements are far more exacting and rigid. The 6809 processor is an unusual beast to

A guide to the 6809

say the least, it is an old and very powerful design from the Motorola Corporation and has been around for many years, but it is still unrivalled in terms of specification and architecture. Some of you may have heard of the so called "wonderchip" the MC68000 which has been said to revolutionise the world of CPU controlled systems. It is being used in systems which require astronomical amounts of processing and

memory (in comparison to the home computer). Computers such as the Apple Macintosh to Computer synthesisers such as the Kurzweil all require this amount of processing, computer graphics require so much memory and fast processing times that the new generation of chips have had to "grow up" to be not only flexible but fast with it, the same 68000 is based on the general architecture as the M6809.

The main advantage and power that the 6809 has over other 8 bit processors is that it has two eight bit accumulators which are usable as a single sixteen bit register. There are three general purpose index registers, a hardware stack pointer and a program instruction counter. The other advantage that the M6809 processor brings is its ability to run advanced software tools simply not available on the 6502 as well as an industry standard operating system called FLEX.

FLEX is probably one of the most underrated operating systems of all time, it has features which literally use the 6809 processor to its full potential by taking CP/M's concept of the User/BIOS interface a step further by comprehensively linking a computer's individual I/O requirements in a series of overlay files. These files may be tailored by the user or by the company implementing FLEX (normally the latter), so in this case FLEX can support both the BBC's sound and graphics facilities as well as more immediately useful interfaces such as the user ports and analogue ports on the Beeb. FLEX does however require some prerequisites, a double disc system is absolutely essential as is a 8271 based DFS (Watford's DFS as well



CONTINUED OVER

```

#HELP FLEX
FLEX 0.1
C <adr1> <adr2> CRC check
D <adr1> <adr2> Dump memory
F FLEX warm start
G <adr> Go to Hex address
I Initialise Monitor
K <adr1> <adr2> <data> Fill memory
L <adr1> <adr2> <FROM> Load 6502 RAM
M <adr> Memory examine
O <adr1> <adr2> Offset calculation
Q <adr1> <adr2> Test memory
R Registers
S <adr1> <adr2> <TO> Xfer to 6502 RAM U Upload FLEX

```

OS 1.20
>

Fig 1. The CUBE Monitor ROM

as their DDFS will work perfectly, the DDFS being in single density mode).

There are at present only two companies building 6809 second processors for the BBC Micro, Control Universal (who went to see last year) and Cambridge Microprocessor Systems (CMS). Both design complete 6809 systems around the BBC Micro for serious and industrial applications, supporting their second processor boards with industry standard "Euro" racking systems which allow extra hardware devices to be plugged in and taken out and to control devices amongst many other various tasks.

CUBE EUROBEEB/ BEEBFLEX

The Control Universal board is enclosed in a four slot mini Euro rack which contains both the housing and the power supply for the 6809 processor board as well as a second card for 64K Dynamic RAM chips, the remaining two slots can be used for extra analogue to digital converters or EPROM blowers or high resolution Graphics cards (all made by Control Universal).

The housing is made from rugged metal in the same cream colour as the BBC's case, the Euro cards are further protected by aluminium retaining plates, where there are interfaces to connect to the outside world a suitable hole is made, in the 6809 CPU Card's case these include a hole for the Tube interface which is a length of ribbon cable which is over 4 feet long!! at last a Tube device which

can sit a reasonable distance from the Beeb. Also included is a FLEX configuring ROM which plugs into one of the BBC's sideways ROM sockets, this allows the BBC Micro to communicate with the Euro cards via the Tube, the ROM is also used to format discs to the FLEX standard.

Installing the CUBE ROM is a simple matter of unscrewing the BBC's retaining screws and simply plugging it in any vacant sideways ROM socket, fixing the TUBE interface to the top of the micro's case by sticky rubber feet and plugging the ribbon cable into the TUBE socket, you can then replace the lid of the Beeb and upon issuing a "FLEX" command you may now enter the FLEX monitor. Fig 1 Shows all the CUBE Monitor commands. The CUBE monitor is a basic version of the FLEX standard monitor which allows the user to examine any part of the 6809's 64K DRAM chips which includes the whole FLEX environment as well as any workspace, it allows information from the BBC's memory to be loaded into a suitable address in the 6809, with care I was able to load the very same View file from a BBC Micro with a 6502 second processor into the CUBE memory. By then saving the file (still in FLEX) I was able to read the file in using SCREDITOR, a FLEX based word processor. More "Standard" features allow examining blocks or bytes of memory and examining registers on the 6809 in a typical 16 bits per line representation, the monitor also allows the user to generate Cyclic Redundancy Checking (CRC) numbers for the 6809 DRAMs and any 6809 ROMs, more of which later. Connecting BeebFlex proved simple and reliable and with the inbuilt power supply serving the entire

four slot rack, the user need not worry about current drain on the Beeb's board, there is provision for future expansion cards from Control Universal which are also available.

In use the CUBE 6809 board was a little sensitive to dirty mains, anyone switching on a light in another part of the room were liable to crash the system. Normally the mains system is fully screened before any power gets to the delicate chips inside so I was lucky to have my test bench's power supply fully screened during the review. I would have liked to have seen at least a LED on the front suggesting that the unit is on, unfortunately the only way to find out, next to looking over the unit at the position of an on/off rocker switch is to feel the side of the case to detect if the unit is humming softly.

CMS-6809 Single Board

A very different beast is the CMS 6809 second processor. Their product plugs into the BBC Micro via the Tube without any power supply requirements, using all low power RAM/ROM technology. The single board approach makes for a more compact card which can attach itself under the Beeb's case by using rubber feet which stick the board to the upper inside case, out of harm's way and as it requires no other power from the TUBE it can operate quietly and coolly with even a fully populated issue 7 BBC board. The unit worked fine with a DDFS board, the Aries Board as well as a fully populated 16 socket ROM board, by virtue of its compact size, it is very easy to forget that the bee has its own operating system at all!! and living snugly inside the BBC's case meant that a whole host of "where shall I put this box now" problems were avoided.

As with the CUBE system, CMS use a Monitor ROM to both format FLEX discs and to communicate with the system for passing information across from BBC Micro to FLEX environment, Fig 2 shows some differences in the monitor ROM as some important commands are included.

As can be seen, the CMS monitor has all of the usual features one would expect, it has a few similarities with the CUBE ROM but has more facilities such as its ability to set up to three Breakpoints, search for a specified string in the 6809 RAM map or a Jump to address/Goto monitor start address command.

Typing "FLEX" puts the user in a Mode 0 screen with a much nicer display being simply white on black, other Modes can be selected by typing 8V (Ctrl V) followed by the Mode number. In operation the CMS and CUBE systems are very similar except that the CMS board is slightly faster on disc accesses than the CUBE system especially when loading FLEX.

There is an optional battery backup for the on board CMOS devices as well as two 28 pin byte wide memory sockets. With the existing system this is taken up by one ROM chip, but providing the user writes their own ROM software, there is no need to have this installed unless under program development. Incidentally, the board has the capability of being a fully stand-alone industry standard 6809 computer with the addition of a few extra components, and the reduction of a ribbon cable, making a target system easy to install.

The difference between the CUBE system and the CMS board is mainly one of size, the CMS board does not require a separate power supply, and has the RAM chips situated as a bank of eight DRAM chips, all serviced by use of a bipolar PROM, this saves physical board space and can in the long run only help matters as the board sits comfortably inside the BBC Micro. CMS boards do support Euro racking and they market a very nice racking system for many different rack widths which includes its own power supply and supports all standard Euro rack cards as well as the complete CMS range. It has the advantage of being available if a rack extension is necessary whereas the CUBE board actually requires the presence of the rack in order to supply power and to communicate with the 64 DRAM chips, this is added on to the price of the CUBE board, making an initially expensive product. With the CMS racking

```
#HELP FLEX
Enter 6809 monitor by #FLEX
Use U0 to boot from FLEX disc
Or control F to boot from rom
```

```
CMS monitor commands
B <adr1> Set up to 3 breakpoints
C <adr1> <adr2> CRC check
D <adr1> <adr2> Display memory
E      Display stack page
F FLEX warm start
G <adr> Go to Hex address
I Initialise Monitor
J <adr1> Go to hex, return to monitor
K <adr1> <adr2> <data> Fill memory
L <adr1> <adr2> <FROM> Load from 6502 RAM
M <adr> Memory examine
O <adr1> <adr2> Offset calculation
Q <adr1> <adr2> Test memory
R Registers
S <adr1> <adr2> <TO> Xfer to 6502 RAM U <n> Upload FLEX from drive
n
W <adr1> <adr2> <hex string> search for string
```

```
OS 1.20
>
```

Fig 2. The CMS Monitor ROM with extra commands

expansion, their 6809 board is given the capability of driving other Euro cards which are again fully supported from within CMS; they consist of a high resolution colour graphics card which offers 64K dedicated graphics memory and a resolution of 512 X 256 pixels and four colour planes. The screen is easily controlled from languages such as PL/9 and includes both black and white displayed simultaneously with full colour, the BBC Micro can thus drive a screen from its own graphics memory and using FLEX, drive a second screen. The most amazing feature of the graphics card is its ability to hardware vector the screen which means extremely fast processing speeds are capable (CMS benchmarks state that the card is capable of drawing over 1.5 Million dots per second, and I believe them!).

The card has two distinct modes of operation, a colour mode where it can display 8 colours per pixel or 8 colours (flashing) or 8 colours and a separate intensity plane, or a black and white mode with 16 levels of grey. There is an internal ROM which handles the character set and drives a text mode which supports all possible colour combinations (85 colour). With the inclusion of the lightpen socket, it is quite plain that this is a very flexible graphics tool, extending the Beeb's capabilities quite a bit, industrial CAD applications are the most obvious use for this board, although as a general

screen driver, its performance is still excellent.

The other cards include a Twelve Bit Analogue interface, this performs the task of connecting the computer to the outside world, it essentially does the job of the Beeb's own A/D port but far more accurately and with speed which would be of main use in real time processes. CMS' very own 6502 second processor which can be accessed and controlled from within FLEX, has a far more flexible memory setup than Acorn's, a nice point is that this processor need not require precise lengths of ribbon cable and looks to be a little less cumbersome and can be controlled and daisy chained from other Euro boards.

FLEX SOFTWARE

So the FLEX system is operational, but unless the user wants to program in pure Hex Mnemonics, the user is likely to require some software. My thanks go to CMS and Control Universal for supplying me with exceptional software to fully test systems. As could be expected both the CMS and CUBE software interacted with no problems, the software I was given to look at included "PL9", a programming language which is enough to make me want to give up all other languages, "FORTH" the all purpose control language, released by CMS, "C" a full implementation with a full specification

floating point compiler, Lucidata PASCAL which is a true P-Code, full spec Pascal compiler as well as SCREDITOR, the aforementioned Word Processor for FLEX systems, an extra. CUBE has supplied me with the ATPL EPROM programmer with both BBC and FLEX software to drive it from both ends of the system. It is perhaps in this light that we can see just how viable FLEX is as an operating system and how it overcomes the problem that all operating systems have never really been able to overcome, even CP/M and that is one of true portability.

The disadvantage with having a "standard" machine and operating system is plain to see when we look at the latest attempt with the Z80 chip in Japan with MSX, Microsoft's so called answer to CP/M on home computers. In short it is awful and isn't even a true "standard" as MSX cassette tape formats are not even compatible. The Z80 suffers when "standards" are imposed because as a processor, it is getting a little long in the tooth, and the CP/M system is only as good as its weakest machine, FLEX has the advantage here in that most 6809 machines supporting a disc drive (either 5.25 or 8 inch) normally support FLEX or OS9 which is semi-compatible. The disc format is exactly the same on 5.25 inch drives and can thus read any FLEX disc, the whole processor is used whereas some CP/M companies have made use of EMT calls which although allow

them to read CP/M discs do not allow CP/M discs created on that machine to be read by all the other machines, which somewhat defeats the point.

FLEX does not have any of the irregularities of CP/M nor does it have much business software, as it centres around engineering and the like, therefore a host of high quality languages and toolkits have emerged which use the power of the 6809 to its full.

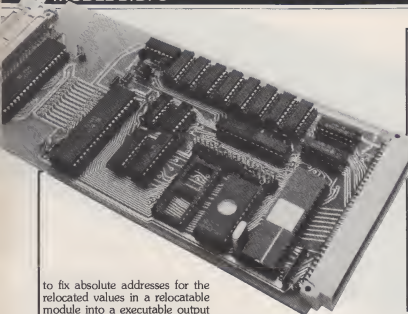
LUCIDATA P-CODE PASCAL

PASCAL is from the very first page in the manual a well crafted product, the implementation sits well within FLEX and has a very friendly user interface and can support the TYPEs Boolean, Scalar, Char, Byte and Integer, the compiler is extremely efficient and compiles code down to .BIN files suitable for execution in FLEX. I would imagine that Lucidata PASCAL will already have many satisfied users, especially in an environment where Pascal is long accepted and a wealth of routines exist for those wishing to use it.

INTROL "C"

"C" was probably one of the most talked about languages of 1984 and certainly software houses were falling over themselves to release a version for CP/M, Macintosh etc etc, now FLEX users can compile full specification "C" files for their own systems. The software house, Introl Corp are confident on its capabilities with additions such as a full 6809 assembler for translating assembly language text files into relocatable object files as well as its ability to create relocatable (position independent) code via the Loader (this is used as in all decent C Compilers

CONTINUED OVER



to fix absolute addresses for the relocated values in a relocatable module into an executable output file) which is normally called by the Linker.

Also included is a library manager system which resolves all references to procedures or routines outside of the file currently being compiled, this library manager searches a special library file and extracts only the modules needed to link the file; this can be used by the programmer to individually create new libraries and to maintain existing ones.

The whole "C" compilation process takes quite a while but what remains is about the most efficient and exacting a compiler can get to run under a run-time system, there is also the future ability to operate the library manager part of the compiler in a number of "modes" where the user is allowed to enter commands allowing simple additions and deletions, naturally an interactive mode allows the user to enter direct commands straight from the terminal or to temporarily store the linker/loader process or even to use a command file mode similar to the IBOOT directive in Acom's DFS commands.

WINDRUSH PL/9

PL/9 has been a long awaited answer for not only myself but for many programmers who simply

cannot get down to writing long assembler programs for tasks that require compactness and speed and have suitable interfaces to the system hardware. With compilers there is also the legal requirement which sometimes makes the run time system only available after a licence has been bought, normally quite expensive if a product is to be sold on a large scale.

For program development there is normally the cycle of source created by an editor and then written back at the end of an edit, then the compiler is loaded for compiling and testing and if unsuccessful the file is again loaded into the editor for debugging. Most programmers agree that this is cumbersome on single user systems of Microcomputers, so PL/9 has the added advantage of having the editor, the compiler and the debugger stored in the same program, the system uses the FLEX transient program area for "Trace" and "Debug" options. In all the compiler requires 16K to operate leaving a full 32K for the source and binary files for testing and then for compilation the user invokes a single command to compile the code into pure stand alone code for use in either ROM or RAM areas in the 6809.

The Trace-debugger allows the

```
001  INCLUDE IOSUBS;
002  INCLUDE REALCON;
003  INCLUDE PRNUM;
004
005  PROCEDURE FACTORIAL (REAL NUM);
006
007      IF NUM <=1 THEN RETURN REAL 1;
008
009  ENDPROC REAL NUM*FACTORIAL (NUM-1);
010
011  PROCEDURE TEST: REAL NUM;
012
013      NUM=0;
014  REPEAT
015      NUM=NUM+1;
016  PRINT (" \nFACTORIAL ");PRNUM(NUM);
017  PRINT (" IS ");PRNUM(FACTORIAL (NUM));
018  UNTIL NUM=10;
```

Fig 3. Shows a Factorial solving Algorithm.

user to single step or breakpoint through a PL/9 program and a source line which enables the user to examine variable names throughout the whole debug session. The structures are loosely based around the control structures found in "BASIC", "PASCAL", "C" but not including the exotic data types in the latter two. There are no functions included which support I/O routines or special peripheral devices, this is because the PL/9 compiler has to work on a number of FLEX machines with different specifications. CMS were very kind in including the most important I/O routines (including Graphics and Sound which are easy to set up anyway). PL/9 uses these "Functions" if they are present by INCLUDING them in a file, an obvious solution really. Fig 3 shows a typical example of PL/9 code before it is submitted to the compiler.

PL/9 makes good use of the 6809's rather unusual architecture by fully supporting data types, BYTE (8 bit) and INTEGER (16 bit) as well as REAL (32 Bit .. 8 bit exponent and 24 Bit Mantissa) the floating point is accurate to seven decimal places, PL/9 is one of the easiest languages to come to grips with, the code is very easy to write

(and read) there are few syntax limitations, and is obviously structured. There are however a number of problems involved when calling routines which access output devices such as the User Port, some protocols have to be written into the INCLUDE functions but these are very easy to set up (for instance using the RS423 as a 1200 baud receive and 75 baud send for 6809 Terminal software).

I thoroughly enjoyed using PL/9 and I am quite frankly surprised why I haven't heard more of this wonderful programming language, it now makes tasks previously only possible with an assembler open to either those who cannot be bothered to use machine code (it is tedious at the best of times no matter how great the intellectual satisfaction) or an easy way to write readable and debuggable code which is absolutely necessary in a real programming environment where money is at stake. In all but the most stringent cases, the rest can be left to spotty little boys with glasses and dandruff, PL/9 is a "real" programming language I can truly feel at home with. It has the best of all possible worlds, in which the compiler is fast in creating stand alone ROMable code. In short, I'm hooked.

Product

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